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Ptychosperma macarthurii or *P. bleeseri*? The taxonomic status of *P. bleeseri* reconsidered

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ABSTRACT

The name *Ptychosperma macarthurii* (syn. nov. *Ptychosperma bleeseri*) is formally adopted by the research staff of the Northern Territory Herbarium as applying to Northern Territory populations of this widespread northern Australian and Papua New Guinean species. This decision was reached after careful appraisal of the published literature before and since the rediscovery of *P. bleeseri* in the Northern Territory in 1982. This decision takes into consideration results from previously published works including: comments made by the original author of the species, assessment of taxonomic decisions made in the world-wide revision of *Ptychosperma*, taxonomic assessment of the species complex containing *P. macarthurii*, isozyme analysis of the NT and some Queensland populations, and biogeographical evidence of other monsoon rainforest species.

KEYWORDS: Arecaceae, *Ptychosperma bleeseri*, *Ptychosperma macarthurii*, taxonomy, nomenclature.

INTRODUCTION

Specimens of the palm *Ptychosperma* Labill., from the Northern Territory (NT) were first collected in 1925 by F.A.K. Bleeser from Bankers Jungle, near Koolpinyah, east of Darwin, and described by Burret (1928) as *Ptychosperma bleeseri* Burret. The distinctiveness of *P. bleeseri*, according to Burret (1928), was based on the narrower leaflets including the terminal pair. Essig (1978), in his revision of *Ptychosperma*, equated the description of *P. bleeseri* with that of *Carpentaria acuminata* Beec. In the absence of type material, Essig (1978) drew this conclusion after personal communication with H.E. Moore who indicated that there were no *Ptychosperma* species present at the type locality. Specimens of *P. macarthurii* (syn. *P. bleeseri*) have since been rediscovered at Banker's Jungle (Anon. 1998). The original collection of *P. bleeseri*, Bleeser 430, was accessioned at the Berlin Herbarium (B) which was destroyed during WWII. In 1982 *P. bleeseri* was rediscovered growing at Howard River and has subsequently been listed by Dunlop (1987), Dunlop *et al.*, (1996) and Cousins (1989) in checklists of NT vascular plants. However, prior to his retirement in December 2000, Dunlop (unpublished) altered the Northern Territory Herbarium (DNA) checklist, relegating the name *P. bleeseri* to synonymy under *P. macarthurii*. In 1991 the late Robert Tucker, former curator of the Townsville Palmetum, was the first person to raise doubts about the taxonomic distinctiveness of *P. bleeseri* (Glenn Wightman pers. comm.). The taxonomic distinctiveness of *P. bleeseri* is also not recognised by the current research staff of DNA and all NT checklists generated since 2000 have appeared with the name *P. macarthurii*. The purpose of this report is to present the evidence supporting the view of the DNA research staff regarding the acceptance of *P. macarthurii* as opposed to *P. bleeseri*.

There has been much written about the conservation of the NT rare palm, *P. bleeseri*. Duff *et al.* (1992), Liddle *et al.* (1992), Barrow *et al.* (1993), Bishop (1993), Liddle *et al.* (1996), and Anon (1998) all have produced documents outlining the threats, population changes, recovery plan, and management of this palm. However, a consistent omission underlying these documents is the fact that they have not addressed the taxonomic uncertainty associated with the species. As *P. bleeseri* has been the focus of major conservation efforts and is listed as endangered by Commonwealth (www.ea.gov.au/epbc/) and NT (Territory Parks and Wildlife Conservation Act, 2001) legislation, the lack of documented evidence supporting the decision to recognise *P. macarthurii* over *P. bleeseri* must be addressed.

ASSESSMENT OF MORPHOLOGICAL CHARACTERS

Ptychosperma has been arranged by Essig (1978) into four subgenera, one of which, *Ptychosperma* subg. *Actinophloeus* (Becc.) Becc. consists of the section

Caespitosa Essig and eontains the complex of species that are closely related to *P. bleeseri* (Dowe 1993a). In an effort to establish the taxonomic distinctiveness of *P. bleeseri*, Dowe (1993a) undertook a taxonomic study of cultivated specimens grown at the Townsville Palmetum. Ineluded in his study were five specimens of *P. bleeseri* from Bankers Jungle, NT, three specimens of *P. macarthurii* from Iron Range, Queensland (Qld), and non-provenanced living material of *Ptychosperma microcarpum* (Burret) Burret. However, without authentieated provenanced material the possibility of hybrid plants cannot be excluded, as Essig (1977) pointed out that cultivated plants hybridise freely. No material of *Ptychosperma propinquum* (Bece.) Bece. ex Martelli was examined, instead data was extracted from the species description. This combination of species was chosen presumably because of their close relationship to each other (see Essig 1978).

Characters of taxonomic significance in *Ptychosperma* were discussed by Essig (1978). They included habit, indumentum, leaves, inflorescence, flowers, fruit, and seeds. The five vegetative characters and five reproductive characters used by Dowe (1993a) in his assessment of the four taxa are presented in Table 1.

Habit. The four speeies in the '*P. macarthurii*' complex are all clumping palms and Essig (1978) has used this character to erect the section *Caespitosa* (Figs 1, 2). The remaining *Ptychosperma* species are all solitary. Some attention has foeused on the deeumbent or leaning habit as a character allowing recognition of *P. bleeseri* (Jones 1984; Brock 1988; Wightman and Andrews 1989). Although this habit is common in the NT populations, Dowe (1993b) indicated that populations of *P. macarthurii* in Qld also exhibit this character. Dowe (1993b) hypothesised that the leaning habit of some NT individuals could be a response to the seasonally dry climate (hard environment) and could possibly be the reason why the decumbent or leaning habit is also exhibited by populations of *P. macarthurii* occurring in similar habitats on western Cape York, Qld. The deeumbent habit is not exhibited by cultivated plants (Dowe 1993a; I. Cowie, unpublished data, D. Dixon pers. obs).

Indumentum. The shape, size, colour, number and distribution of large conspicuous ramenta on the abaxial leaf surface is often of diagnostic value according to Essig (1978). Dowe (1993a) does not discuss shape, size or colour of the ramenta, but does indicate that in *P. bleeseri* various organs can be glabrous or sparingly ramentaceous as opposed to modcrately to densely ramentaceous in the other three speeies (Table 1).

Leaves. Considerable taxonomic weight has been plaeed on the width of the terminal leaflets as a means of separating *P. bleeseri* from *P. macarthurii*. In distinguishing *P. macarthurii* from *P. bleeseri*, Burret (1928) drew attention to the broader terminal leaflets in *P. macarthurii*, a feature which Dowe (1993a) stated has proved to be of relevant diagnostic value. Essig (1978) however, mentioned that at the specific level

Table 1. A comparison of the species and characters treated by Dowe (1993a) in assessing the taxonomic position of *Ptychosperma bleeseri*.

Character	*P. bleeseri*	*P. macarthurii*	*P. microcarpum*	*P. propinquum*
Ligule	Very often dry and deciduous	More often green and persistent	More often green and persistent	More often green and persistent
Tomentum	Petiole, crownshaft apex and ligule glabrous or sparingly ramentaceous	Often moderately or extremely densely ramentaceous and somewhat persistent	Often moderately or extremely densely ramentaceous and somewhat persistent	Often moderately or extremely densely ramentaceous and somewhat persistent
Pinnae arrangement	Evenly distributed or irregularly clustered	Evenly distributed or irregularly clustered	Clustered	Clustered
Terminal pinnae	Narrow	Usually broad	Narrow	Not known
Leaves in crown	4–6	Usually twice the number in *P. bleeseri*	Usually twice the number in *P. bleeseri*	Not known
Rameal braets	Small/moderate	Large/prominent	Large/prominent	Large/prominent
Inflorescence axes	Yellow/green, with moderately dense light coloured pubescence	Yellow/green, with moderately dense punctate scales, glabrescent	Yellow/green, with moderately dense punctate scales, glabrescent	Colour unknown, pubescence dense and dark coloured
Pistillode	Slightly longer than *P. macarthurii* and *P. microcarpum*	Slightly shorter than *P. bleeseri*	Slightly shorter than *P. bleeseri*	Not known
Stamen number	28–34	26–40	18–30	33–50
Fruit	No discernible differences between each species			

only the shape of the central pinnae of a leaf was of diagnostic value in *Ptychosperma*. Of two *P. macarthurii* specimens growing in the palm house of the Berlin Botanic Gardens, Burret (1928) could not distinguish one from *P. bleeseri*, providing further evidence of the variability of *P. macarthurii*. Plants with narrow leaflets also occur on Cape York Peninsula. Tucker (1988) indicated that populations of *P. macarthurii* from around Bamaga, Qld, can consist of plants that are very small and finely pinnate.

Fig. 1. Habit of *Ptychosperma macarthurii* from Crocodile Creek, NT. Photo: A. Gibbons, Northern Territory Herbarium photo database.

Fig. 2. Habit of *Ptychosperma macarthurii* from Claudie River, Iron Range, Queensland. Photo courtesy of Queensland Herbarium.

Inflorescence, flowers, fruit, and seed. Essig (1978) listed stamen number, shape of the pistillode, and external colour of the flowers as characters of some diagnostic value. Dowe (1993a) found some slight differences in pistillode length and stamen number but given the small number of individuals examined, these characters should be used with caution. Essig (1978) warned that stamen number should be used with caution when characterising species. No discernible differences in fruit of the four species could be found by Dowe (1993a). Similarly, only differences in indumentum density on the inflorescence were found between *P. bleeseri*, *P. macarthurii*, and *P. microcarpum* (Table 1).

Dowe (1993a) concluded with the statement that "morphological comparison of *P. bleeseri*, *P. macarthurii*, *P. microcarpum*, and *P. propinquum* indicates that they are closely related integrants of a species' complex which lack well defined boundaries". Dowe (1993a) stated further that if Essig's specific circumscriptions are maintained for species within the section, then *P. bleeseri* is sufficiently distinct to maintain its separation. However, Essig (1978) has placed *Ptychosperma hospitum* (Burret) Burret and *Ptychosperma julianettii* Becc. ex Martelli into synonymy under *P. macarthurii* stating that "the features used to distinguish them are rather trivial, *P. hospitum* having narrower pinnae and generally more delicate proportions, and *P. julianettii* somewhat more robust and having a more fastigate inflorescence". An indication of the narrow species concepts employed by Burret in his evaluation of *Ptychosperma* and allied taxa can be gained from further examination of Essig's *Ptychosperma* treatment. Essig (1978) placed 13 of Burret's taxa, including eight *Ptychosperma* species, three *Strongylocaryum* Burret species and one *Ponapea* Becc., species in synonymy under other *Ptychosperma* species. Essig (1978) has also stated that "some of the currently recognised species may ultimately be found to represent only geographic subsets of larger species, for data on range and variability for many species are as yet insufficient for secure definition of their limits".

ASSESSMENT OF ISOZYME ANALYSIS

As a result of the conservation measures undertaken to protect *P. bleeseri*, Shapcott (1998) assessed populations of *P. bleeseri*, *P. macarthurii*, *Ptychosperma elegans* (R. Br.) Blume and *C. acuminata* for isozyme variation. Three hundred and thirty-nine *Ptychosperma* specimens which included 223 wild

collected *P. bleeseri*, seven cultivated *P. elegans* and three cultivated *P. macarthurii* of known provenance were assessed. Although the data obtained by Shapcott (1998) are valuable in assessing the genetic variability in the NT populations, they are of little use taxonomically for a number of reasons. Shapcott (1998) stated that *P. bleeseri, P. elegans* and *P. macarthurii* were distinct species as they showed clear and consistent differences at several loci. However, Gottlieb (1977) in a paper dealing with the use of electrophoretic data in plant systematics recommended that the temptation to compare electrophorectic data by direct inspection, i.e. counting the number of bands with similar or dissimilar mobilities, in preference to genetic analysis, should be rejected. Shapcott (1998) stated that no statistical analysis was carried out on the data. Her conclusion about the taxonomic distinctiveness of *P. macarthurii* and *P. bleeseri* is based on three specimens of *P. macarthurii* which were arguably from the same population at Iron Range. However, Gottlieb (1977) advocated that in order to have a 95% confidence, that at least one copy of each allele is included in an analysis, at least 60 individuals should be sampled. Furthermore, not all congeneric taxa believed to be closely related to *P. bleeseri* were analysed for comparison. Finally, it should also be noted that Shapcott (1998) was not trying to answer a taxonomic question, but rather assess the genetic integrity of *P. bleeseri* in order to enhance management strategies.

BIOGEOGRAPHICAL EVIDENCE

Ptychosperma has its centre of distribution in Papua New Guinea (PNG) with 29 species recognised by Essig (1978, 1987). Two species, *P. elegans* and *P. macarthurii*, occur in Qld with disjunct populations of *P. macarthurii* (syn. *P. bleeseri*) occurring in the NT, and PNG. In the NT, *P. macarthurii* (syn. *P. bleeseri*) is known to occur in eight patches of lowland monsoon vine forest in a 40 hectare area adjacent to the Adelaide River floodplain and the Howard River system east of Darwin (Anon. 1998). Shapcott (1998) hypothesised that *P. bleeseri* probably originated from a common genetically depauperate source and that its populations have either been so severely restricted and have since expanded from a refugial population, or that the populations have arisen from a founder event. The restricted distribution and low genetic variability of the NT populations compared with the known distributions of the other taxa in the species complex, i.e. *P. macarthurii* in Qld and PNG, *P. microcarpum* in PNG, and *P. propinquum* in Indonesia is consistent with possible dispersal pathways that could lead to a founder event. Given the fact that *P. bleeseri* does not occupy all available suitable habitats, on either a regional scale or within individual rainforest patches (Barrow *et al.* 1993), is further evidence that a long distance dispersal (founder) event has occurred.

If consideration is given to the fact that *P. bleeseri* is an outlying population of the widespread *P. macarthurii*, then this is consistent with the broader pattern of biogeography of the local lowland monsoon vine forest flora. A large proportion of this flora are vagile species often occurring over a wide geographic range on relatively recent land forms such as stabilised beach dunes and riverine floodplains (Russell-Smith and Dunlop 1987). Thus a high proportion of NT rainforest taxa are shared with Qld (78%), New Guinea-Solomon Islands (57%), Western Australia (51%), SE Asia (38%) and even the Indian subcontinent (32%) (Liddle *et al.* 1994). As might be expected, the proportion of NT endemic species in this flora is low at just 6% (Liddle *et al.* 1994). Whilst some rainforest taxa are common and widespread in the NT, others are disjunct and of restricted distribution, with concentrations of the latter on the Tiwi Islands and in sandstone habitats of western Arnhem Land-Kakadu. Amongst the species with NT-New Guinea or NT-eastern Indonesia disjunctions are *Elaeocarpus meigi* Weibe, *Croton argyratus* Blume, *Schoutenia ovata* Korth., *Pittosporum moluccanum* (Lam.) Miq., *Tropidia curculigoides* Lindl., and *Helicteres hirsuta* Lour., (Hartono 1965; Liddle *et al.* 1994). Other than the NT, these six species do not occur elsewhere in Australia.

In addition, a high proportion (91%) of the lowland rainforest flora of the Alligator Rivers Region of the northern NT have fleshy fruits or other types of bird-attractive propagules, probably also providing dispersal opportunities for the plant species involved (Taylor and Dunlop 1985). In addition, possible dispersal pathways across land bridges between northern Australia and New Guinea have been a regular feature of the recent geological past. The waters forming the Arafura Sea and Torres Strait probably first came into existence in the Pleistocene (2.5 mya). This land bridge has disappeared and reformed at least seven times in the intervening period in response to climatically driven rising and falling sea levels (Barlow 1981). The climate of the exposed land bridges may well have been at least as arid as the Carpentaria region is today (Barlow 1981). However, permanent springs supporting rainforest vegetation were presumably a feature of the landscape then as they are today in much of northern Australia and provided islands of suitable habitat along which rainforest species could disperse.

CONCLUSION

It appears that following the rediscovery of *P. bleeseri*, the taxonomic assessment of the species was based on evidence extracted from too few sources. Only five cultivated provenanced collections of *P. macarthurii*, three cultivated provenanced specimens of *P. bleeseri*, non-provenanced cultivated material of *P. microcarpum*, and the species description of *P. propinquum* were used by Dowe (1993a) in his assessment of the species. Similarly, Shapcott (1998) based her comparisons of the species on only three cultivated provenanced collections of *P. macarthurii*, all of which originated from a similar locality. Using information from a number of sources that adequately described the variation found in populations of *P. macarthurii*, and taking into consideration the reasons why Essig (1978) synonymised two species under *P. macarthurii*, the decision to adopt the name *P. macarthurii* for the NT populations is justifiable. This decision to recognise *P. macarthurii* over *P. bleeseri* is also supported by the biogeographical evidence relating to other monsoon vine forest species and the overall distribution of congers in the *P. macarthurii* complex. The evidence presented in this paper indicates that *P. bleeseri* is taxonomically indistinguishable from *P. macarthurii* and may indeed be indistinguishable from *P. propinquum*. Further, the evidence presented strongly supports the hypothesis that the NT populations are the result of a founder event. The characters used by Dowe (1993a) clearly overlap and are based on too few specimens, they do not take into consideration the possibility of a founder event and do not agree with distributional trends of other monsoon vine forest taxa. The authors, having seen the two species growing, can find no evidence to separate the NT populations from *P. macarthurii*, therefore, the name *P. macarthurii* is accepted as applying to the NT populations of this widespread taxon.

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